

A RAPID ASSESSMENT OF SPIDER DIVERSITY IN KABIGAN FALLS, PAGUDPUD, ILOCOS NORTE, PHILIPPINES

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ABSTRACT

A rapid assessment of spider diversity in Kabigan Falls, Pagudpud, Ilocos Norte. Spiders are the most permeating predators in both agricultural and natural ecosystems. In ecological studies, they serve as indicators of environmental quality and as biological control agents in agricultural ecosystems. A total of 38 individuals collected from Kabigan Falls were comprised of 13 species. These species are from the family Araneidae, Sparassidae, Pholcidae, Salticidae, and Tetragnathidae. Most of the specimens collected from the site were under families Tetragnathidae and Araneidae. The most species-rich family is Araneidae (5). These include the following: *Araneus inustus*, *Cyclosa insulana*, *Cyclosa mulmeinensis*, *Cyclosa spirifera* and *Larinia* sp. Newly-recorded spiders include are *Tetragnatha plena* Chamberlin, 1924, a new Philippine record; and new locality distributed spiders are *Chalcotropis luceroi* Barrion & Litsinger, 1995 and *Pholcus arayat* Huber, 2011.

KEYWORDS: spiders, Kabigan Falls, spider diversity, taxonomy, Araneae, Tetragnathidae

INTRODUCTION

Spiders are amongst the most ubiquitous predators in both agricultural and natural ecosystems. They are nature's master spinners of silken webs and are gaining favour in ecological studies as indicators of environmental quality (Clausen 1986; Churchill 1995) and as biological control agents in agricultural ecosystems as means of controlling arthropod pests (Bishop and Riechert 1990; Riechert and Lockley 1984).

Spiders belong to Order Araneae, Class Arachnida and are members of Phylum Arthropoda, the largest assemblage of animals with jointed legs and hard exoskeleton. Members of these families are uniquely characterized by the presence of two body regions namely the cephalothorax and abdomen. The cephalothorax usually bears a pair of chelicerae, a pair of pedipalps, four walking legs, and four pairs of homogeneous eyes (Barrión and Litsinger 1995).

The potential of spiders as natural control agents of agricultural pests such as mites has aroused the interest in learning more about their abundance and species composition in different ecological systems. Humans also benefit from the presence of these organisms. Since the spiders' diet includes other insects that are potentially harmful and are considered pests, they also helped in the maintenance of the food web. In addition, spiders also serve as food for birds, lizards and other animals. Spiders are also a commercially important: they help in the large population of silk production and the threads of their webs are used as hairlines in optical instruments (Barrión and Litsinger 1995).

Approximately there are 120,000 species of spiders' worldwide (Barrión and Litsinger 1995) and there are only a few recorded data and studies done regarding local Philippine spiders due to limited resources and few local arachnologist. Most of the collections are limited to riceland habitats (Barrión and Litsinger 1995). Moreover, only few localities and provinces have been surveyed based on the occurrence of this organism. Thus, this study aims to have a rapid assessment and identify the occurrence of spiders in Kabigan Falls, Ilocos Norte.

MATERIALS AND METHODS

Study site and study design. The study was conducted in Kabigan Falls, Barangay Balaoi in the town of Pagudpud, Ilocos Norte ($18^{\circ}35.516N$ $120^{\circ}51.620E$) in the morning of April 29, 2013. Kabigan Falls is 1.8km far from the national road and can be reached by foot in about half an hour. The waterfall is approximately 87 feet high and the water drops into a concave basin. "Kabigan" was derived from the Tagalog word "Kaibigan" which means friend. The name was provided because it was believed that the water from the river and the falls are "*magkaibigan*" (friends) (Fig. 1).

Moreover, in order to identify the occurrence of the spiders in the study site, relative species abundance was determined by getting the number of individuals per species and dividing the total number of the individuals collected using an opportunistic sampling method. Furthermore, the percent abundance of the spiders by family was also considered (Henderson, 2003).

Collection of specimens. Collection was done along the 1.8 kilometer road towards Kabigan Falls. Bushes, herbs, and trunks of trees were checked for the presence of spiders and a vial tapping and opportunistic sampling

method was used to catch the spiders. Four persons were maneuvering and collecting specimens for the span of two hours along the road. All spiders collected were housed singly in plastic containers and were later placed in bottles containing ethanol for transportation. These were transported to the Biology Laboratory of Thomas Aquinas Research Complex, University of Santo Tomas for sorting and identification.

Identification of spiders. Unknown spiders were identified to its designated order to family level, then genus and its species if possible. In all cases, the identification of the spider is based on available keys, figures and descriptions from Green (1996), Barrion and Litsinger (1995), and Koh (1989, 2000). Characters useful for identification are examined in detail namely: body shape, eye pattern, and nature of web, eye arrangement, chelicerae, shape of the sternum, maxillae, and legs. In order to facilitate observation of these characters, the spiders were mounted in a Petri dish containing 70% ethyl alcohol to prevent the specimen from drying up. A dissecting microscope was used to view the details of some features which are invisible to the naked eye. For final identification, specimens were sent to University of the Philippines Los Banos Museum of Natural History. All specimens were identified, courtesy of Dr. Aimee Barrion-Dupo and Dr. Alberto Barrion.

Preservation of collected spider samples. According to Barrion and Litsinger (1995), spiders, unlike insects cannot be preserved in a dry state since their bodies are soft and prone to shrivel. Initial preservation of spiders was placed in a glass jar or vial with 70% ethyl alcohol for 24-48 hours to disregard any diluted bodily fluids. The solution was replaced and each specimen was labelled properly.

Documentation. For purpose of documentation and appreciation of the anatomical description, photographs were prepared using dissecting microscope, and ELMO Document Camera P10 to accompany the systematic account.

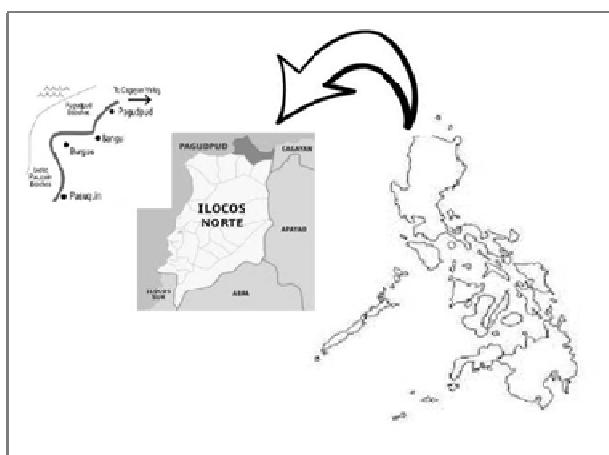


Figure 1. Map of Kabigan Falls, Barangay Balaoi, Pagudpud, Ilocos Norte

RESULTS AND DISCUSSION

Species composition, diversity and occurrence. Based from the collection done along the track of Kabigan Falls, Pagudpud, Ilocos Norte, the spiders were identified to belong to five families (Araneidae, Sparassidae, Pholcidae, Salticidae, and Tetragnathidae) which is listed and described below (Table 1):

Phylum Arthropoda

Class Arachnida

Order Araneae

Family **Araneidae** (Dahl, 1912)

Araneus inustus (L. Koch, 1871)

Cyclosa insulana (Costa, 1834)

Cyclosa mulmeinensis (Thorell, 1887)

Cyclosa spirifera Simon, 1889

Larinia sp. Simon, 1874

Family **Sparassidae** (Simon, 1874)

Heteropoda venatoria (Linnaeus, 1767)

Family **Pholcidae** Koch

Pholcus arayat Huber, 2011

Family **Salticidae**

Chalcotropis luceroi Barrion & Litsinger, 1995

Plexippus petersi (Karsch, 1878)

Telamonia festiva (Thorell, 1887)

Family **Tetragnathidae**

Opadometa fastigata Simon, 1877

Orsinome n. sp. (Thorell, 1890)

Tetragnatha plena Chamberlin, 1924

Table 1. Important morphological characters and descriptions of the five (5) families

Family	Description
Araneidae	Common Name: Orb-Weavers, Garden spider Distribution: There are approximately 3,500 species worldwide, with 180 occurring north of Mexico. Characteristics: The Araneidae are ecribellate, entelegyne, three-clawed spiders, having eight eyes in two rows. The lateral eyes are usually adjacent and some distance from the medians; the four medians form a trapezoid. The smallest orb weavers are less than 1/4 inch (6 mm) and the larger orb weavers can grow over 1 inch (25 mm). Female: Most people recognize the female orb weaver spider shape: a large "golf ball"-like abdomen and a smaller head; Male:

Adult male orb weavers are smaller, and are not seen as often, as they generally do not spin webs, but wander in the search for potential mates.

Sparassidae

Common Name: Huntsman spider, Giant-crab spider, Wood spider

Distribution: Occur in most warm temperate to tropical regions of the world, including much of Australasia, Africa, Asia, the Mediterranean Basin, and the Americas

Characteristics:

Huntsman Spiders are large to very large size spiders. Most of them have flattened body suitable to live inside the narrow gaps under bark, log and stone. They are usually brown or grey in colours. The spiders have crab-like legs - all legs bend forwards. They can walk backwards, forwards and sideway. Their front two pairs of legs are usually much longer than back. Active during the night and they hide in their retreat, under bark or some other shelter, during the day. Instead of chasing prey, most huntsman spiders wait at the spots where insects will come by. It is believed that the coming and going of insects put down scent trails that the huntsmen can pick up. Have eight eyes in two rows of four, all dark in colour. They are believed to have poor eye-sight.

Pholcidae

Common Name: Cellar spiders, Daddy long-legs spider

Distribution: Found in every continent in the world besides Antarctica where it is too cold for them to survive. They hang inverted in messy, irregular, tangled webs. These webs are constructed in dark and damp recesses, in caves, under rocks and loose bark, abandoned mammal burrows in undisturbed areas in buildings and cellars, hence the common name "cellar spiders". However, Pholcids are also quite commonly found in warm, dry places, such as household windows and attics.

Characteristics:

Pholcids are fragile arachnids, the body being 2–10 mm in length with legs which may be up to 50 mm long. *Pholcus* and *Smeringopus* have cylindrical abdomens and the eyes are arranged in two lateral groups of three and two smaller median contiguous eyes. Eight and six eyes both occur in this family. *Spermophora* has a small globose abdomen and its eyes are arranged in two

groups of three and no median eyes. Pholcids are gray to brown with banding or chevron markings. The shape of the *Pholcus* and *Smeringopus*'s body resembles that of a peanut.

Salticidae

Common Name: Jumping Spider

Distribution: Tropical forests harbor the most species, but they are also found in temperate forests, scrub lands, deserts, intertidal zones, and mountainous regions.

Characteristics:

The cephalic area is more hairy than the thoracic area. The eight eyes are arranged in two rows wherein the anterior eye row is recurved while the posterior eye row is nearly straight to slightly procurved. The sternum is yellowish brown with spurs and brown spots opposite each leg. It is longer than wide wherein it is truncated anteriorly and narrowed to a blunt point posteriorly.

Tetragnathidae

Common Name: Long jawed-orb weaver

Distribution: Found in long vegetation near water

Characteristics:

The cephalothorax has a pale yellow to yellowish brown color. Cephalic area is not markedly narrower than the thoracic area. The arrangement of the two rows of eyes is recurved wherein the anterior eye row is slightly longer than the posterior eye row. The sternum is heart-shaped and brownish yellow in color with gray brown marks in midposterior portion. Labium is dark brown in color with pale yellow distal margin and it as long as wide. The maxillae is yellowish brown in color and longer than wide. Chelicerae are strong and stout. Legs are pale yellowish brown in color with black markings in the apices. Abdomen is mostly orange-red and silvery white in color with black markings. It is oblongate in shape and broadest in its posterior while the anterior end is rounded to slightly truncate. It is strongly overhanging the carapace. The venter of the abdomen has a pair of bracket-like patches with silvery spots between the epigastric furrow and spinnerets.

Moreover, a total of 38 individual spiders were collected from the site in which the genus *Orsinome* n. sp. under the family Tetragnathidae had the most number of individuals (13) and with a relative abundance of 0.342 (Table 2).

Table 2. List and occurrence of spider species from Kabigan Falls, Pagudpud, Ilocos Norte.

Species	No. of individuals	Relative abundance
<i>Araneus inustus</i>	1	0.026
<i>Cyclosa insulana</i>	3	0.078
<i>Cyclosa mulmeinensis</i>	3	0.078
<i>Cyclosa spirifera</i>	3	0.078
<i>Larinia</i> sp.	1	0.026
<i>Heteropoda venatoria</i>	2	0.053
<i>Pholcus arayat</i>	3	0.078
<i>Plexippus petersi</i>	1	0.026
<i>Telamonia festiva</i>	1	0.026
<i>Chalcotropis luceroi</i>	1	0.026
<i>Orsinome</i> n. sp.	13	0.342
<i>Tetragnatha plena</i>	3	0.078
<i>Opadometa fastigata</i>	3	0.078
TOTAL	38	

Based on the number of individuals in a family (Fig. 2), Tetragnathidae is the most abundant in which 19 individuals (percent abundance of 50%) were collected and includes three (3) genera (*Opadometa fastigata*, *Orsinome* n. sp., *Tetragnatha plena*). This family consist of long-jawed spiders which build their webs in grassy or bushy areas near water (Barrión & Litsinger, 1995) (Table 1). It is assumed that they are the most abundant in the area since the trail going to Kabigan Falls consists of rice fields, river streams and wooden bridges. Moreover, members of this family exhibit long legs and body with round abdomen, thus they are visible in the type of collection method done by the researchers which is a hand-picked technique along the selected site.

On the other hand, Family Araneidae is the second most abundant collected spiders with 11 individuals (percent abundance of 29%) but with the highest identified species namely *Araneus inustus*, *Cyclosa insulana*, *Cyclosa mulmeinensis*, *Cyclosa spirifera*, and *Larinia* sp. (Fig. 2). Araneidae are the typical orb-weaver spiders, in which their web consists of concentric rings and series of radii that hang down from the center of the web (Barrión & Litsinger, 1995). The presence of such web would make it more visible and obvious during collection hence the large number of species was identified. It is also believed that the high occurrence of both Tetragnathidae and Araneidae is due to high plant diversity and vegetation around the site which is also associated

with rich abundance of insects. The presence of spiders in an area will be more likely to be found where insect population is also high.

New records. From the collected spiders identified in the study site, it was found out that *Tetragnatha plena* is a new Philippine recorded species, while *Chalcotropis luceroi* and *Pholcus arayat* are considered as new recorded spiders in the local area (Fig. 3).

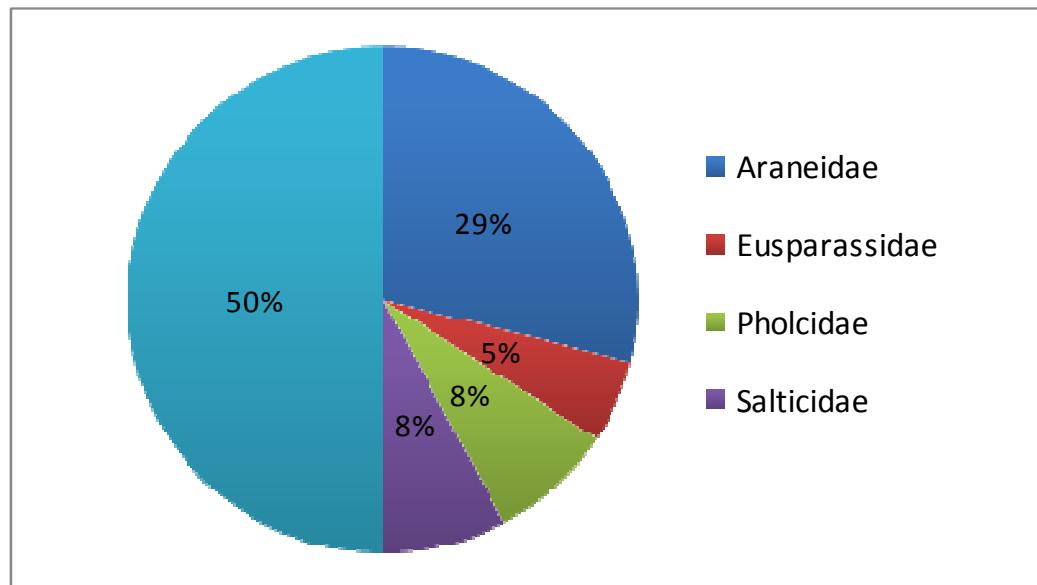


Figure 2. Percent abundance of spiders based on their family

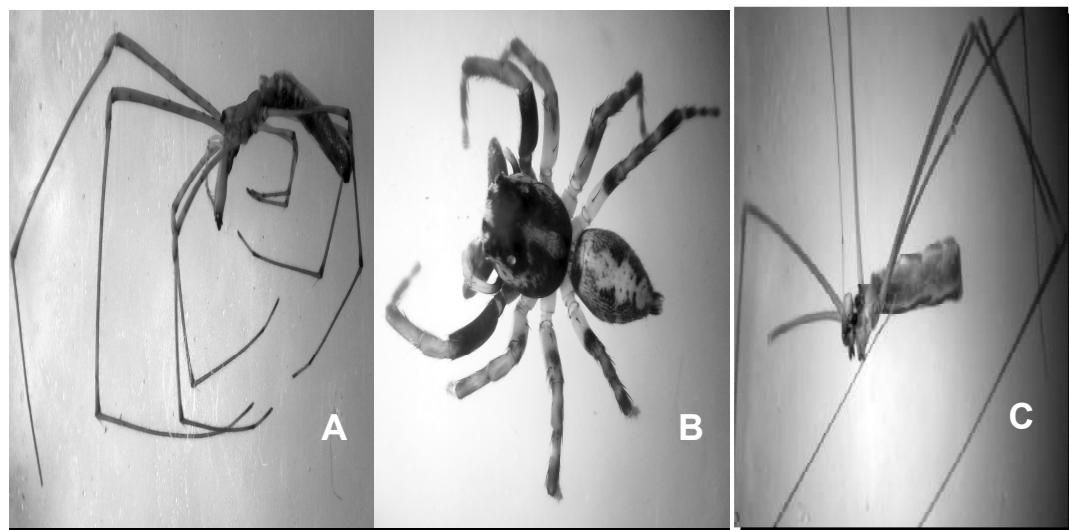


Figure 3. Newly recorded species. (A) *Tetragnatha plena* in lateral view which is a new Philippine recorded species, (B) *Chalcotropis luceroi* in dorsal view and (C) *Pholcus arayat* in lateral view which are both considered as new recorded species in the local area.

CONCLUSION AND RECOMMENDATION

Spiders are air-breathing arthropods that have eight legs and chelicerae with fangs that inject venom. They are the largest order of arachnids and rank seventh in total species diversity among all other groups of organisms. However, it is threatened by multiple factors that reduced its numbers and lessen its diversity.

Based on this rapid assessment of the occurrence of spiders in Kabigan Falls, the number of spiders collected was 38 individuals that belong to five (5) families Araneidae, Eusparassidae, Pholcidae, Salticidae, and Tetragnathidae from which 13 species were identified. From the 13 species collected in the area, three (3) of which are considered as new in Philippine record and new based on local record, these are *Tetragnatha plena*, *Chalcotropis luceroi* and *Pholcus arayat* respectively.

Most of the specimens collected from the site were under families Tetragnathidae and Araneidae that have 19 and 11 recorded individuals respectively. But based on the number of species identified, Araneidae is most abundant with five (5) species which comprise of *Araneus inustus*, *Cyclosa insulana*, *Cyclosa mulmeinensis*, *Cyclosa spirifera*, and *Larinia* sp.

Although this is only a rapid assessment of spider diversity in the area, the presence of such number of organisms were already observed. These also include the discovery of three newly recorded species. These only imply that there are still a lot of place, and organisms which are actually less explored especially in a rich and diverse country like the Philippines. These also include local studies on spiders which are relatively low because of less support among taxonomists.

Moreover, even though the diversity index was taken into account, the data is not enough to establish the species richness of the entire site. Therefore, a follow-up study that will cover a larger study site is suggested to further identify species richness and even species diversity especially in a tourist spot like Kabigan Falls, Pagudpud, Ilocos Norte. The three newly discovered species in the local area must also be further described for documentation purposes and for the addition of the existing knowledge of Philippine spiders.

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